

MEMC 02-0201 (3035.1)
PATENT

REMARKS

Claims 1-46 are pending in this application.

Response to Claim Rejections

CLAIMS 1-12

Claim 1 is directed to a crystal puller for growing monocrystalline ingots according to the Czochralski method. The puller comprises:

a housing;

a crucible in the housing for containing a semiconductor source material melt, the melt having an upper surface;

a side heater adjacent the crucible for heating the crucible;

a pulling mechanism for pulling a growing ingot upward from the upper surface of the melt, *a portion of the upper surface of the melt remaining exposed during growing of the ingot*, the exposed upper surface portion having an area; and

an annular melt heat exchanger sized and shaped for surrounding the ingot and for being disposed adjacent the exposed upper surface portion of the melt, the heat exchanger including a heat source disposed to face the exposed upper surface portion of the melt, the heat source having an area for radiating heat to the melt sized at least 30% of the area of the exposed upper surface portion of the melt for controlling heat transfer at the upper surface of the melt, the melt heat exchanger being adapted to reduce heat loss at the exposed upper surface portion.

Claim 1 is patentable over the references of record, including JP Patent Application No. SHO 63-8291 (Ueya)¹, because the references fail to show or suggest a crystal puller having a

¹ An English language translation of JP Patent Application No. SHO 63-8291 is being filed simultaneously herewith in a Second Supplemental Information Disclosure Statement as cite no. 65.

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portion of the upper surface of the melt remaining exposed during growing of the ingot.

As shown in Fig. 1, Ueya discloses a semiconductor manufacturing apparatus having a gas tight vessel (41) and a melt tank (42) located in the vessel. An electric heater (52) is positioned inside the wall (43) of the melt tank (42) for melting a semiconductor base material to form a melt (51), and a liquid surface heating apparatus (60) is provided for maintaining the temperature of the upper layer of the melt (51). A cover liquid (53), such as a low-melting-point glass liquid or the like, covers the melt (51) for preventing "gasification" thereof.

As a result of the cover liquid, the melt of Ueya does not have a portion of its upper surface exposed during growing of the ingot. Instead, Ueya discloses that the melt is covered by a liquid to prevent "gasification". In other words, the Ueya apparatus increases the dissolved gas concentration in the melt by reducing the surface area available for transport and traps gases (e.g., oxygen) in the melt, rather than allowing the gases to leave the melt. As a result, the gases, such as oxygen, remain in the system in high concentration where they can negatively impact the resulting ingot. See, for example, pages 3-5 of applicant's specification which discusses oxygen precipitation.

Applicant's claimed puller, on the other hand, recites that a portion of the upper surface of the melt remains exposed while the ingot is being grown. This allows gases, such as oxygen, to exit the melt and thereby prevent the gases from negatively impacting the ingot.

Accordingly, claim 1 is unanticipated by and patentable over Ueya. Claims 2-12 depend from claim 1 and are patentable over Ueya for at least the same reasons as claim 1.

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CLAIMS 21-24

Claim 21 is directed to a method of growing a monocrystalline ingot comprising forming a melt of semiconductor source material in a crucible, the melt having a surface;

positioning a heat source to face the exposed upper surface portion of the melt, the heat source having an area for radiating heat to the melt sized at least 30% of the area of the exposed upper surface portion of the melt

pulling semiconductor source material from the surface of the melt such that the source material solidifies into a monocrystalline ingot;

selectively controlling heat transfer at the surface of the melt using the heat source.

To the extent claim 21 recites the same features as claim 1, claim 21 is unanticipated by and patentable over Ueya for the same reasons as set forth above with respect to claim 1.

Claims 22-24 depend from claim 21 and are patentable over Ueya for at least the same reasons as claim 21.

CLAIMS 13-20 AND 25-46

On pages 2 and 3 of the Office action, the Office has taken the position that claims 13-20 and 25-46 are unpatentable over Ueya in view of U.S. Patent No. 6,117,402 (Kotooka) and JP 11-255,577 (Shinrin). However, the Office fails to establish a *prima facie* case of obviousness with respect to any of these claims. Particularly, the Office fails to point out how each claimed feature is shown or suggested by the listed references. For example, claim 13 recites, in part, a cover, a crystal heat exchanger at least partially inside the cover, and a melt heat exchanger at least partially inside the cover. The Office action simply fails to state which of the cited references or the

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teachings therein the Office believes shows or suggests each of the features.

In the event the Office maintains its rejections of claims 13-20 and 25-46, applicant respectfully requests that a more detailed explanation of its position by identifying the specific reference(s) and the teachings therein that the Office believes show or suggest each and every feature recited in the claims. Moreover, the explanation should state the reason for combination.

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CONCLUSION

In view of the foregoing, allowance of the application is respectfully required. The undersigned requests a telephone call from the Examiner if this would expedite allowance of the application.

The Commissioner is hereby authorized to charge the one-month extension of time fee in the amount of \$120.00 to Deposit Account No. 19-1345. The Commissioner is also authorized to charge any underpayment or credit any overpayment to Deposit Account No. 19-1345.

Respectfully submitted,



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